CLAIMS

1. A supported or self-supporting electrochemical transistor device comprising:

- a source contact,
- a drain contact,
- at least one gate electrode,
- an electrochemically active element arranged between, and in direct electrical contact with, the source and drain contacts, which electrochemically active element comprises a transistor channel and is of a material comprising an organic material having the ability of electrochemically altering its conductivity through change of redox state thereof, and
- a solidified electrolyte in direct electrical contact with the electrochemically active element and said at least one gate electrode and interposed between them in such a way that electron flow between the electrochemically active element and said gate electrode(s) is prevented,

whereby flow of electrons between source contact and drain contact is controllable by means of a voltage applied to said gate electrode(s).

2. An electrochemical transistor device according to claim 1, in which said source and drain contacts, gate electrode(s) and electrochemically active element are arranged in one common plane.

3. An electrochemical transistor device according to claim 2, in which a continuous or interrupted layer of said solidified electrolyte covers the electrochemically active element and covers at least partially said gate electrode(s).

4. An electrochemical transistor device according to any one of the preceding claims, in which at least one of said source and drain contacts and gate electrode(s) is formed from the same material as the electrochemically active element.

5. An electrochemical transistor device according to claim 4, in which all of said source and drain contacts and gate electrode(s) are formed from the same material as the electrochemically active element.

6. An electrochemical transistor device according to any one of claims 4-5, in which the source and drain contacts and the electrochemically active element are formed from a continuous piece of said material comprising an organic material.

7. An electrochemical transistor device according to any one of the preceding claims, in which said transistor channel retains its redox state upon removal of the gate voltage.

8. An electrochemical transistor device according to any one of claims 1-6, in which said transistor channel spontaneously returns to its initial redox state upon removal of the gate voltage.

9. An electrochemical transistor device according to claim 8, in which the electrochemically active element further comprises a redox sink volume adjacent to the transistor channel, the device comprising at least two gate electrodes arranged on opposite sides of the electrochemically active element so that one gate electrode is closer to the transistor channel and one gate electrode is closer to the redox sink volume.

10. An electrochemical transistor device according to any one of the preceding claims, in which said organic material is a polymer.

11. An electrochemical transistor device according to claim 10, in which said polymer material is selected from the group consisting of polythiophenes, polypyrroles, polyanilines, polyisothianaphtalenes, polyphenylene vinylenes and copolymers thereof.

12. An electrochemical transistor device according to claim 11, in which said polymer material is a polymer or copolymer of a 3,4-dialkoxythiophene, in which said two alkoxy groups may be the same or different or together represent an optionally substituted oxy-alkylene-oxy bridge.

13. An electrochemical transistor device according to claim 12, in which said polymer or copolymer of a 3,4-dialkoxythiophene is selected from the group consisting of poly(3,4-methylenedioxythiophene), poly(3,4-methylenedioxythiophene) derivatives, poly(3,4-ethylenedioxythiophene), poly(3,4-ethylenedioxythiophene) derivatives, poly(3,4-propylenedioxythiophene), poly(3,4-propylenedioxythiophene) derivatives, poly(3,4-butylenedioxythiophene), poly(3,4-butylenedioxythiophene) derivatives, and copolymers therewith.

14. An electrochemical transistor device according to any one of the preceding claims, in which said organic material further comprises a polyanion compound.

15. An electrochemical transistor device according to claim 14, in which said polyanion compound is poly(styrene sulphonic acid) or a salt thereof.

16. An electrochemical transistor device according to any one of the preceding claims, in which said solidified electrolyte comprises a binder.

17. An electrochemical transistor device according to claim 16, in which said binder is a gelling agent selected from the group consisting of gelatine, a gelatine derivative, polyacrylic acid, polymethacrylic acid, poly(vinylpyrrolidone), polysaccharides, polyacrylamides, polyurethanes, polypropylene oxides, polyethylene oxides, poly(styrene sulphonic acid) and poly(vinyl alcohol), and salts and copolymers thereof.

18. An electrochemical transistor device according to any one of the preceding claims, in which said solidified electrolyte comprises an ionic salt.

19. An electrochemical transistor device according to any one of the preceding claims, which is self-supporting.

20. An electrochemical transistor device according to any one of claims 1-18, which is arranged on a support.

21. An electrochemical transistor device according to claim 20, in which said support is selected from the group consisting of polyethylene terephthalate, polyethylene naphthalene dicarboxylate, polyethylene, polypropylene, polycarbonate, paper, coated paper, resin-coated paper, paper laminates, paperboard, corrugated board and glass.

22. A process for the production of a supported electrochemical transistor device comprising:

- a source contact,
- a drain contact,

- at least one gate electrode,
- an electrochemically active element arranged between, and in direct electrical contact with, the source and drain contacts, which electrochemically active element comprises a transistor channel and is of a material comprising an organic material having the ability of electrochemically altering its conductivity through change of redox state thereof, and
- a solidified electrolyte in direct electrical contact with the electrochemically active element and said at least one gate electrode and interposed between them in such a way that electron flow between the electrochemically active element and said gate electrode(s) is prevented,

which process comprises deposition of said contacts, electrode(s), electrochemically active element and electrolyte onto a support.

23. A process according to claim 22, wherein said contacts, electrode(s), electrochemically active element and/or electrolyte are deposited by means of printing techniques.

24. A process according to claim 22, wherein said contacts, electrode(s), electrochemically active element and electrolyte are deposited by means of coating techniques.

25. A process according to any one of claims 22-24, in which device said organic material comprises a polymer, which process comprises deposition of said polymer on a support through *in situ* polymerisation.

26. A process according to any one of claims 22-25 comprising patterning of any one of said contacts, elec-

trode(s) and electrochemically active element using a subtractive method.

27. A process according to claim 26, in which said patterning is performed through chemical etching.

28. A process according to claim 26, in which said patterning is performed through gas etching.

29. A process according to claim 26, in which said patterning is performed by mechanical means, comprising scratching, scoring, scraping and milling.

30. A process according to any one of claims 22-29, in which said supported electrochemical transistor device is as defined in any one of claims 2-18 and 20-21.